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In re application of PATRICK, ET AL) Examiner: RILEY SHAWN
Serial No. 10/081,847) Art Unit: 2838
Filed: 02/26/2002) Docket No.: N883B

Title: POWER GENERATION WITHIN A MOTIONLESS ELECTROMAGNETIC GENERATOR

Commissioner of Patents & Trademarks
Washington, D.C. 20231

DECLARATION OF THOMAS E. BEARDEN

That I, THOMAS E. BEARDEN, declare as follows:

1. That I am a co-inventor of the above-captioned patent application.

2. That I have been awarded a BS degree from Northeast^{32.6} Louisiana University in 1953; a MS degree from Georgia Tech in 1971 and a PHD degree from Trinity College in 1999. That I have been in active duty as an officer in the Army for 21 years with a specialty in missile technology and since retirement from the service have been employed as a senior scientist for various aircraft and missile companies.

3. That I have read the Office Action and am familiar with the conclusions reached by the Examiner and am in full disagreement with these conclusions and offer these reasons for my disagreement.

4. The patent examiner is not totally versed in thermodynamics (specifically, in nonequilibrium thermodynamics), or physics. It appears that he is also unaware of the flawed foundations assumptions in the standard classical EM model, as pointed out by Feynman, Wheeler, Bunge, Margenau, and many other eminent scientists.

The book, Energy from the Vacuum: Concepts and Principles, Cheniere Press, 2002, authored by myself and others deals with answering just such assertions, inaccuracies, falsities, etc. In that book the exact principles for COP > 1.0 EM power systems taking their excess energy

from the active vacuum were advanced. There is no other such text available in the literature to my knowledge, and apparently there never has been. Indeed, the entire class of Maxwellian systems which freely change their potential energy (regauge) *asymmetrically*—and thus freely transfer potential energy to the system from the gauge-transformed vacuum—have continued to be ignored since Lorentz symmetrically regauged the Maxwell-Heaviside (M-H) equations prior to 1900 ^{1},^{2}. Lorentz's symmetrical regauging, incorporated to this day, thereby discards the entire class of M-H systems exhibiting $COP > 1.0$ and taking free regauging energy from the active vacuum.

Classical Electrodynamics (CED) and Electrical Engineering (EE)

Are Seriously Flawed

The Classical Maxwell-Heaviside electrodynamics model (used also in electrical engineering), is more than 100 years old. It is seriously flawed and *it has been seriously flawed for more than a century* and take its start for the sake of convenience as an 1865 paper by Maxwell ^{3}, which was formally read in 1864.

E.g., the CED/EM model erroneously assumes force fields existing in mass-free space, which implicitly assumes a thin material ether filling all space. The notion of a force or force field in mass-free space is totally false and it is well-known to be false.

E.g., consider E , the electric field intensity, where $E = F/q$. In this equation, E is defined as the effect (force F produced) in and on a unit point static charge q (containing mass) *assumed* at every point in the spatial field. The force F does not exist unless the charged mass of charge q is present. The definition of the force field thus assumes the presence of mass. If it is an electromagnetic force field, it assumes the presence of charged mass ^{4}. More rigorously, force fields exist only in matter. They do not and cannot exist in mass-free space. As Feynman states ^{5}:

"...in dealing with force the tacit assumption is always made that the force is equal to zero unless some physical body is present... One of the most important characteristics of force is that it has a material origin..."

As an example of the form in which the electric force field actually exists in *massless space*, Feynman points out that ^{6}:

"...the existence of the positive charge, in some sense, distorts, or creates a "condition" in space, so that when we put the negative charge in, it feels a force. This potentiality for producing a force is called an electric field."

A potentiality to produce a force under certain conditions does not constitute the force itself; the cause of an interaction product is not the *effect* (the product). Feynman correctly points out that the source positive charge simply produces a *condition in space itself*. I.e., it distorts its surrounding space. That spatial distortion (the field in space) is an effect from the source charge, and so the charge is the primary cause of the field. Feynman does not mention the mechanism by which this spatial distortion is actually accomplished. That mechanism remained hidden until finally provided by Bearden {84} in 2000.

This "surrounding spatial distortion" caused by the charge is its associated *field*, but it is not a force field. *The field itself is just a distortion in the local spacetime*. The "field in space" produces a force field in charged matter, when it interacts with that charged matter placed in that distorted spatial region {⁷}. It is the *distorted space itself* that is the form of the E-field in space, e.g. No force or force field exists until that distorted space entity (force-free field) interacts with charged mass. That interaction *then* produces a force field (with the charged mass as a component) in the matter that is being acted upon.

In short, the force field is an effect from a more primary force-free field cause, and the force field is *not* the primary cause. This means that it is possible to directly engineer force itself, in a force-free and work-free manner. The implications are astounding, and include negative entropy engineering {21}.

Force is an Ongoing Interaction Between Distorted Spacetime and Mass

Mass is always a component of force, and force must have a material (mechanical) definition. Where momentum p is given by $p = mv$, a material definition of force F may be taken from mechanics as

$$F \equiv \partial p / \partial t = m \partial v / \partial t + v \partial m / \partial t$$

As can be seen, mass is indeed a component of the ongoing interaction called "force" since m is a component of every term on the right. In the absence of mass, there can be no force and there can

be no field of force because *one of the necessary constituent components of the interaction that identically is force is missing.*

The “Force Field in Space” Error Is Ubiquitous

The CED and EE model used in all universities (and by the U.S. Patent Office) therefore is in very serious fundamental error, by continuing to assume force fields in mass-free space. Basic mechanics is also in serious error, where a separate force in mass-free space is considered to be acting upon a separate mass. The “separate force in mass-free space” *does not exist*. The spatial field entity actually interacting with the mass, and thereby producing a force, is only a *warping of spacetime* (i.e., Feynman’s distortion of space, which may consist of spacetime curvature, torsion, or a combination of both).

The Material Ether. In the 1800s the early physicists and electrodynamicists—including Maxwell—assumed a thin material ether filling all space. In their minds, *there was no point in the universe where mass was absent*. To them, the fields and potentials in “space” were *fields and potentials in the material ether*. These “spatial fields” were thus taken to be very material, and quite similar to material fluids in fluid dynamics. Since they were always in matter, “obviously”—to the early physicists and to the Maxwellians—these EM fields were force fields and were quite material in nature.

In 1887, the Michelson-Morley experiments {20} destroyed the material ether, thereby annihilating the prevailing assumption of material force fields in space. *But to this day*, the equations of the Maxwell-Heaviside model (used in electrical engineering) have never been changed to rid the model of their hidden *material ether assumption*.

Serious Flaws in Present Electrodynamics. By continuing to assume these “mass-containing” force fields in massfree space, the EE model continues to assume a luminiferous material ether, more than a century after such was experimentally falsified.

The model also assumes an inert vacuum (falsified since 1930) and a flat spacetime (falsified since 1916). Hence the CED and EE model erroneously assumes that no EM system can freely receive and use extra EM energy from its active external natural environment (said vacuum and said curved spacetime). The model falsely assumes that this active natural environment is inert

and that there is no energetic exchange between it and the system. Hence the silly model assumes that regauging is impossible, in contradiction to its own use of Lorentz symmetrical regauging of the Maxwell-Heaviside equations {1} to “make them easier to solve”.

Thermodynamically the EE model assumes that, with respect to interaction with curved spacetime and active vacuum, the Maxwellian system is “isolated” from such—which is obviously quite impossible. There is absolutely no way to “isolate” a system from being embedded in active spacetime and in the active vacuum. And there is absolutely no way to render *noncurved* the spacetime of a physical system with ongoing energy densities and dynamics. There is no way to render the system’s local active vacuum inactive and “inert”. Consequently, there is no way to prevent continuous and appreciable active interaction between the system and its modern vacuum/curved spacetime environment. The EE model completely omits these dynamics and energy exchanges.

The physical system itself is always embedded in the supersystem {⁸}, consisting of three components: (i) the physical system and its dynamics, (ii) the distorted local spacetime and its dynamics, and (iii) the local active vacuum and its dynamics. All three components of the supersystem continuously interact with each other. *This is not modeled at all in the CED and EE model.*

In EE practice, the standard closed current loop circuit also contains the “external” power source’s dipolarity, wired into the circuit as a load. This circuit thus makes the back emf and forward emf equal, which *physically self-enforces the Lorentz symmetrical regauging assumption*. The closed current loop circuit—with the external power source’s dipolarity included in it—rigorously and physically *negates any practical use* of the excess potential energy the system continually and freely receives via regauging from its active environment.

The stupid circuit assumes that the external power source’s job is not just to potentialize the external circuit with freely flowing potential energy, but also is to kill itself faster than the load is powered.

Physics Establishes the Active Vacuum and Curved Spacetime. Modern particle physics completely refutes the erroneous classical EM and EE view that the vacuum and spacetime are inert. The vacuum is highly active and incredibly energetic {⁹}. It continually interacts with every

particle of matter, including every charge $\{^{10}\}, \{^{11}\}$. The classical view is also refuted by general relativity, where—at any location or region in any system—a change in potential energy or field energy is a *curvature of the local spacetime* a priori. Further, that ST curvature interacts back upon the system.

In short, GR already verifies that every change in the energy dynamics of a system—at any and every point or region in that system—continuously interacts with its local spacetime to curve it. And that curvature of spacetime then interacts back upon the system to produce real forces and actions in the system. Discussing this interaction with curved spacetime, the renowned physicist John Wheeler says it simply $\{^{12}\}$:

"[Curved] Space acts on matter, telling it how to move... In turn, matter reacts back on space, telling it how to curve."

Note particularly the order in which Wheeler stated it. No dynamics in the material system occurs until the matter first interacts with curved spacetime (and the active vacuum) to form the force of, on, and in that matter. Force itself is not primary, but instead it is produced in and on matter by the interaction of curved spacetime (and the active vacuum) with that matter.

In the general relativity approach, that interaction of curved spacetime upon matter *generates* all forces appearing in the material system itself, as well as their force dynamics. Indeed, from the general relativity view, force can be defined as *the ongoing interaction of curved spacetime with matter*. From the particle physics view, force can also be defined as the ongoing interaction with matter, of a change in the virtual particle flux of the vacuum.

Whenever matter is “forcibly acted upon by a force”, there is actually a force-free curvature of spacetime acting upon the matter and *creating the force itself in, of, and on the matter*, via Einstein’s interaction as stated by Wheeler $\{^{12}\} \{^{13}\}$. Whenever the matter then is forcibly changed, *that* change then acts back on spacetime to change the curvature accordingly, and that curvature change then also interacts back upon the matter to produce force.

So there is a continuing mutual interaction between every point in an EM circuit or system and its active local spacetime (its active vacuum). This primary interaction of modern physics does not appear in classical electrodynamics and electrical engineering at all.

For the foregoing reasons, classical electrodynamics (CED) and electrical engineering (EE) are

totally inadequate to analyze any EM system taking and using excess potential energy from its interactions with the vacuum. Indeed, those deficient and very old classical models cannot show the mechanism whereby a source charge continuously pours out real EM energy, establishing and continuously replenishing its associated EM fields and potentials in surrounding space, but without any input of *observable* energy. Instead, the classical models assume that every EM field, EM potential, and every joule of EM energy in the universe has been freely created from nothing at all by the associated source charge(s). That assumption of the classical models is in total violation of the conservation of energy law.

Though not modeled in CED and EE, every EM system and circuit is already in a continuous two-way interaction with its active local spacetime (and active vacuum), and that is well-known in physics.

Laws of Physics Often Have Peculiar Exceptions.

Fluctuations Violate the Second Law of Thermodynamics. Thermodynamically, the beginning of every such “system-ST curvature interaction” is also a departure of the system from equilibrium, at least momentarily. It represents a *reduction in system entropy* contrary to the *equilibrium-based* second law of thermodynamics.

This type of second law violation (for a statistical departure from equilibrium), is well-known in thermodynamics. It is usually referred to as a *fluctuation* and is covered by various *fluctuation theorems* {¹⁴}. Such known and accepted violations of the second law are often not negligible. E.g., Wang *et al.* {¹⁵} have experimentally shown that such departures violating the second law of thermodynamics in some chemical solutions may last for up to two seconds, purely from statistical variations (fluctuations) alone. In an aqueous solution, that may be a region of some 30 billion molecules and ions where chemical reactions “run backwards” for up to two seconds {¹⁶}. We also strongly point out that the classical Second Law of thermodynamics *assumes a system in equilibrium with its external environment*—the condition of maximum entropy. Speaking of the Second Law, Lindsay and Margenau state its foundations meaning as follows {¹⁷}:

“...statement of the second law: (a) the entropy... is a variable of state. (b) Its value, for a closed system, can never decrease.”

They also bluntly point out the falsity of applying the second law of thermodynamics to a nonequilibrium condition {¹⁸}:

"Equilibrium states are the only ones that are capable of explicit analysis in thermodynamics..."

And again {¹⁹}:

"... variables of state have meaning only if they define an equilibrium state. Hence the quantity we are seeking will be meaningless unless it refers to equilibrium states."

Relativity Disturbs Some Classical Thermodynamics Definitions. Classical thermodynamics

does not include the active vacuum's energetic exchange with the system or the spacetime curvature's energetic exchange with the system. Hence the present classical thermodynamics' definition of a "closed" system—as one where energy crosses its boundary but matter does not—is invalid. Any absorption by the system of excess external energy from the environment increases the mass of the system *a priori*. Any loss of energy by the system to its environment decreases the mass of the system *a priori*. The classical definition of "closed system" assumes that energy crosses the system boundary but mass does not, and the mass of the system does not change. That is false; any change of energy in the system also changes its mass.

So if energy passes back and forth between system and environment, the mass of the system continually changes. Therefore the system does not completely meet the classical thermodynamics definition of a "closed" system. However, as long as the increase or decrease of system mass is small, then the mass changing effect is small and the classical thermodynamics closed system definition may be used as *approximately* correct.

Neither the active vacuum exchange nor the curved spacetime exchange was known when classical electrodynamics and electrical engineering were formed in the 1800s. These old models have not been updated in accord with what physics has already discovered and proved since then.

"Force Fields in Space": CED and EE Still Assume the Material Ether. The Maxwell-

Heaviside equations assume the material ether, by assuming force fields in space—when force fields exist only in matter. I.e., the equations were formed with the assumption of a "luminiferous" thin material ether filling all space. In the view of Maxwell and other electrodynamicists of the time, *there was no point in the universe where mass was absent*. Hence

all fields in space were *material*, in their view.

The material ether concept was falsified by the Michelson-Morley experiments {²⁰} in the 1880s, after Maxwell was already dead. However, even with the ensuing truncation of Maxwell's theory by Heaviside, Hertz, Gibbs, and others after Maxwell's death, none of the resulting Maxwell-Heaviside equations were changed to eliminate their assumption of the material ether—even though the material ether concept was destroyed in 1887. *To this day, not one of those "material ether" EM equations in CED and EE has ever been changed to eliminate that material ether!* Hence CED and EE still erroneously assume the old luminiferous material ether, more than a century after it has been falsified.

Nonequilibrium Decreases System Entropy. As is well known in thermodynamics, the condition of system equilibrium is the condition of *maximum entropy* {²¹}. Hence when any system departs from equilibrium, it *decreases* its entropy a priori. Entropy, of course, is just a measure of energy that is present but made unavailable for further use. Decrease of entropy simply means that additional energy has been made available for use.

Decrease in net entropy is a negative entropy operation, contradicting the Second Law. One violates the Second Law every time one potentializes a system, throwing the system into nonequilibrium and delivering excess energy to it from its environment via the external power supply. Simply potentializing a system throws it into nonequilibrium, because excess energy crossed the system's boundary and into the system from the outside environment. *EE's unknowingly violate the equilibrium Second Law every time they apply voltage to a circuit or system!*

Lindsay and Margenau point out that the entropy of a nonequilibrium system cannot be rigorously calculated, because the fundamental state variables basis for the statistical model itself is violated. Specifically, Lindsay and Margenau state {²²}:

"Non-equilibrium conditions cannot be specified by variables of state, and their entropy cannot be computed. ...the condition of equilibrium is the condition of maximum entropy."

Nobelist Prigogine {²³} sums it up in this fashion:

"Entropy ...cannot in general be expressed in terms of observables such as temperature

and density. This is only possible in the neighbourhood of equilibrium... It is only then that both entropy and entropy production acquire a macroscopic meaning."

On the Operation of the Motionless Electromagnetic Generator

The MEG is a Nonequilibrium System. MEG continually departs from equilibrium and operates mostly far from equilibrium. Thus—precisely as stated by Nobelist Prigogine—entropy and entropy production may have little or no macroscopic meaning for the MEG. Or in other words, by continually departing from equilibrium, the MEG is continually performing a negative entropy operation, permitted by the thermodynamics of *nonequilibrium* systems but forbidden by the thermodynamics of *equilibrium* systems. Any system such as the MEG, continually receiving usable excess energy from its environment, is also continually producing negative entropy operations *a priori*, since it is constantly reducing its entropy. Hence the system is permissibly violating the *equilibrium* Second Law—because it is not in equilibrium—according to well-known and accepted nonequilibrium thermodynamics principles.

Prigogine adds {²⁴}

"This leads precisely to a distinction between 'equilibrium structures' which may be understood in terms of classical equilibrium thermodynamics and 'dissipative structures'. The latter are formed and maintained through the exchange of energy and matter in non-equilibrium conditions.

As can be seen, the MEG is a system deliberately designed to operate far from equilibrium and thus to transcend equilibrium thermodynamics. The moment the MEG takes itself well out of equilibrium via receipt of strong extra E-field energy pulses from its external environment, then classical equilibrium thermodynamics is no longer rigorously obeyed by the MEG. Specifically, the Second Law of equilibrium thermodynamics is no longer upheld, and this type of operation is already well-known and recognized by leading thermodynamicists. Our power engineers just have not built power systems using it!

For analysis of a system operating in nonequilibrium conditions, one passes to the much newer thermodynamics of dissipative structures, formed largely by Prigogine and the Belgian school. In

1977, Prigogine was awarded the Nobel Prize in Chemistry, *for his contributions to non-equilibrium thermodynamics, particularly the theory of dissipative structures.*

Nonequilibrium Operation of the MEG. The motionless electromagnetic generator (MEG) belongs to Prigogine's latter class of nonequilibrium systems, and the MEG functions according to the theory of dissipative structures. This is due to the MEG core material's free generation of the Aharonov-Bohm effect {27},{28} and the resulting *gauge transformation* of the external space immediately outside the core material {32},{34},{35},{36},{37}, {38}. By the Aharonov-Bohm effect, in that gauge-transformed external space there freely arises a curl-free A-potential containing extra regauging energy {27},{28}.

The continual sharp gradients produced by perturbing that A-potential produce strong E-field inputs to the MEG by the well-known equation $dA/dt = -E$.

In turn, these extra E-fields freely impinge upon and interact with every coil on the MEG's core, *freely adding to each coil an extra input of EM energy from the MEG's gauge-transformed external environment.* Every coil on the MEG is thus forcibly operated in the far-from-equilibrium condition. Every coil also has a second function of being an input coil for receipt of extra energy freely from the environment.

Continual strong input signal gradients are introduced by the operator (from the external power supply) into the input coil of the MEG system. These sharp "pulse rise time" and "pulse decay time" gradients continually drive the system into nonequilibrium. They also continually and freely perturb the extra A-potential in the gauge-transformed space outside the core, providing the resulting strong, extra input bursts of E-field energy. Magnitudes of these evoked E-field pulse inputs are adjustable by adjusting the rise time and decay time of the input signal pulses. This means that the MEG system continually and simultaneously produces an *asymmetry* in its energetic exchange with its locally curved and gauge-transformed spacetime, as well as an *asymmetry* in its energetic exchange with its local asymmetrical vacuum. The MEG system is a system continually driven far from equilibrium with its deliberately-activated external environment. Strong gradients of energy—freely generated in the MEG's nearby local asymmetrical region of space—result in the input of these extra pulses of energy—freely arising directly from that asymmetric space region—back into every coil in the MEG system.

This produces a strong violation in the MEG of the equilibrium condition. So the nearby perturbed A-potential produces and furnishes extra energy to the “transformer-like” MEG system. In short, the MEG continually receives strong bursts of extra free EM energy from its said external environment. *Therefore the MEG is rigorously a nonequilibrium system freely receiving excess energy from space (the vacuum) itself.* Accordingly, the MEG functioning differs from that of every conventional transformer.

The MEG is analogous to a common heat pump which, in addition to its EM energy input from the external power supply, also receives excess free or nearly free heat energy from its environment. The heat pump operates as a system far from equilibrium. It has efficiency ξ of $\xi < 100\%$, but it also has COP = 3.0 to 4.0 in nominal operation.

The use of the Aharonov-Bohm effect by the MEG can and does freely induce extra EM energy input to it from the transformed local space (i.e., in the form of the strong E-fields produced from the local curl-free A-potential and input to every coil on the MEG). This disequilibrium allows the MEG to permissibly violate the second law of *equilibrium* thermodynamics, by continually replenishing its available energy to replace that lost due to production of entropy. Permissibly violating the Second Law by nonequilibrium processes and operation does not violate the First Law (conservation of energy).

MEG COP > 1.0 Obeys the Conservation of Energy Law. Conservation of energy (the first law of thermodynamics) *is not violated* by the MEG, once one accounts for its extra energy input from the external environment due to the Aharonov-Bohm effect and the $E = dA/dt$ function. The excess energy is *freely* generated (via asymmetrical regauging) by the MEG in its active vacuum environment and active curved spacetime environment. We note again that regauging is work-free due to the gauge freedom principle.

The extra energy input to the COP > 1.0 MEG from its asymmetrical vacuum/spacetime does not have to be furnished and paid for by the operator, precisely as a heat pump operator does not have to furnish the extra heat energy input to it from the external atmosphere.

The overall efficiency ξ of the MEG is always $\xi < 100\%$ because the MEG does have ordinary system losses. It *never* outputs as much useful energy doing work in the load, as the *total* energy input to it from all sources (from the operator and from the environment as well). However,

because the MEG freely receives additional excess EM energy from its active environment, its *total* energy input is appreciably greater than that *energy component input by the operator only*. Hence the MEG can *output* more energy than the operator alone inputs, exactly analogous to a heat pump's operation.

So the MEG is permitted to exhibit a coefficient of performance of $COP > 1.0$, precisely analogous to a common home heat pump. As is well-known {²⁵}, the variable *theoretical maximum* COP of a standard heat pump, operating as a refrigerator to cool the great outdoors under nominal conditions, may be as much as 9.22.

Curled and Uncurled Magnetic Vector Potential A. In modern physics the curl of the A-potential is known as the **B**-field, from the equation $\mathbf{B} = \nabla \times \mathbf{A}$. When the curled A-potential is withdrawn from a region of space by localization to one part of the region, then in the rest of that region outside the localization part there is left the *curl-free* A-potential which exists even though $\mathbf{B} = \nabla \times \mathbf{A} = \mathbf{0}$ in that region outside the localization. This Aharonov-Bohm process yields an unexpected gain in the total available (usable) energy available. We may simply localize the available **B**-field flux energy in the MEG core region. In that case, *inside the core* we will still have all that **B**-field flux energy (as for a normal transformer) for our use in the system, while *outside the core* we will now have available the *extra* curl-free A-potential energy. That extra A-potential energy is easily transduced into **E**-field energy via $dA/dt = -E$. The magnitude of these **E**-field pulses is controlled by adjusting rise time and decay time of the input signal pulses furnished to the input coil. With the Aharonov-Bohm reaction freely evoked by the MEG's nanocrystalline core material, the MEG has and uses all the *normal* transformer magnetic field energy **B**, while *also* freely producing and using additional strong **E**-field energy component inputs from the gauge-transformed environmental space outside the core. This novel *available energy gain* is as a result of gauge transformation (regauging) of that external space. It is indeed work-free by the well-known gauge freedom axiom of quantum field theory and gauge field theory. As pointed out by Evans and Jeffers {32}, the Aharonov-Bohm effect is a local *gauge transformation* of the true vacuum itself. It does not appear in electrical engineering, but it does

appear in higher group symmetry EM such as $O(3)$ electrodynamics. This extra A-potential energy is real EM energy now freely available in the immediate external space (curved spacetime) outside the core material due to the gauge transformation invoked. Then, by the sharp gradients introduced upon the input pulses to the transformer section, sharp gradients are correspondingly induced upon the magnetic flux within the core. In addition, sharp gradients are also *freely* induced upon the *extra* curl-free A-potential in space outside the core. This sharp perturbation of the external A-potential creates very large E-fields *freely originating in the space outside the core material*, by the common equation $E = -dA/dt$. These strong E-field energy pulses strike every coil wound on the MEG core. This produces multiple inputs of extra environmental energy, something not seen or used in any conventional transformer.

The MEG as a Nonequilibrium System. By invoking and using the Aharonov-Bohm effect, the MEG becomes a system far from energy flow equilibrium with its active A-potential vacuum environment. The MEG now freely receives excess E-field energy directly from that active external environment, *in addition to* the usual energy input furnished from the external power supply and paid for by the operator.

Thermodynamically its operation as a nonequilibrium system freely receiving excess energy from its environment permits the MEG to legitimately achieve $COP > 1.0$ while also rigorously obeying the conservation of energy law. At all times, the overall efficiency ξ of the MEG is $\xi < 100\%$, but it permissibly produces $COP > 1.0$ by the laws of nonequilibrium thermodynamics.

The MEG's operation is thus directly analogous to that of a common home heat pump.

This has nothing to do with "perpetual motion" or with hypothetical systems performing work with no energy input.

These strong but free E-fields freely received by the MEG from its active local spacetime environment (from the perturbed free A-potential just outside the core) interact with every coil on that MEG core so that—in addition to its normal function—*every coil also becomes an input coil for the injection of extra E-field energy from the local dA/dt active environment. This function—multiple free inputs of environmental energy to every coil on the transformer—is not performed at all in conventional transformers.*

MEG Operation is Analogous to the Operation of a Heat Pump. Rigorously, the MEG becomes a Prigogine nonequilibrium system, freely receiving excess energy from its external active environment via the environment's injection of extra and free E-field energy into each and every coil in the MEG transformer section. By carefully adjusting the phasing etc. of these excess free E-field energy injections from the external environment, the resulting collections of excess E-field energy can be made mostly to add in the overall MEG energy collection and output. In that fashion, the MEG actually receives appreciably more input energy than is input by the operator from the external power supply alone.

So the total input energy *available for subsequent output* by the MEG consists of two components: (i) the normal EM energy input and paid for by the operator (from the external power source), and (ii) the additional, sharp injections of excess E-field energy pulses freely input from the active dA/dt environment.

Thus *the MEG operates precisely analogous to a standard home heat pump*. The heat pump has two sources of input energy: (i) the power line energy input and paid for by the operator, and (ii) the extra heat energy extracted from the active (hot or heat-containing) environment.

The overall *efficiency* (useful energy or work out, divided by the total energy input from all sources) of the heat pump is always less than 100%. A nominal typical value of the heat pump efficiency ξ is $\xi = 50\%$, so that half of all the input energy to the heat pump is wasted. However, so much additional energy is freely received from the extra environmental input that, even though half is wasted, the remaining half available from the environment is appreciably more than the half that was wasted from the operator's input.

So more total energy is still available for output by the heat pump than the input paid for by the operator himself. Therefore the coefficient of performance (COP) of the heat pump—where COP is useful energy or work out, divided by the *energy input only by the operator*—is $COP > 1.0$. For the common home heat pump, a nominal value of the COP is $COP = 3.0$ to 4.0 . The heat pump delivers useful work that is three to four times as great in magnitude as could be obtained only from the energy input by the operator if the efficiency were $\xi = 100\%$. It delivers six to eight times as much output energy as could be delivered using only the operator's energy input with 50% efficiency.

When conditions get too cold, and the heat pump has to switch to direct resistance heating, its COP goes to about $\text{COP} = 0.5$ (i.e., numerically equal to the innate efficiency ξ). In those conditions, the heat pump's performance is only about one sixth to one eighth what it is in normal operating conditions. *As everyone has experienced, under those conditions the operator or householder pays very painfully for the copious extra electrical energy that the operator then has to furnish from the power line.*

By freely receiving a strong excess E-field energy input from its local active and free A-potential environment, the MEG differs from any normal transformer. The MEG freely has an extra and quite strong input of excess energy from said active environment, in addition to the power line input energy furnished by the operator and paid for by him. Hence the MEG's operation is precisely analogous to that of the heat pump. Its *overall efficiency* is always less than 100%, but with receipt of sufficient extra free E-field energy from its environment, the MEG is permitted to exhibit $\text{COP} > 1.0$. Nominal $\text{COP} = 3.0$ to 5.0 can be reasonably achieved, and higher COP—including the $\text{COP} = \infty$ condition—is possible by use of additional measures. Nonequilibrium thermodynamics decrees that a system such as the MEG is permitted to exhibit five “magic” functions that equilibrium systems do not and cannot exhibit: The nonequilibrium system is permitted to

- (i) self-order,
- (ii) self-oscillate or self-rotate,
- (iii) output more energy than the operator inputs (the excess energy input is freely furnished by the active environment), so that the system $\text{COP} > 1.0$,
- (iv) “power itself and its load” (all the input energy is freely furnished by the external active environment, so that the system $\text{COP} = \infty$), and
- (v) exhibit negentropy (as does any system that is far from equilibrium, since it decreases its entropy from its condition of equilibrium).

The MEG's Thermodynamic Operation. The standard EM model and the equilibrium model being used by the patent examiner as a basis for his objections are terribly deficient. They are completely inappropriate for analysis of any EM system far from equilibrium in its exchange with its locally *active and gauge transformed vacuum environment*.

Specifically, any sharply pulsed (sharp gradient) system such as the MEG is continually and deliberately driven far from equilibrium, and violation of the second law of equilibrium thermodynamics is permitted and in fact known and recognized for strong gradients {41}. The

far-from-equilibrium condition itself induces the *free and extra energetic change* of the local spacetime environment. The local spacetime becomes curved because of the change in its energy density (the regauging) via the creation of the A-potential from the Aharonov-Bohm effect {27},{28},{32}.

The active environment's interaction back upon the MEG is deliberately changed to E-field energy injection, so that more energy is input to the MEG than the operator inputs from the external power line or other external power source. Any system continually and sharply driven into such nonequilibrium condition does not need to obey the Second Law condition (which rigorously is an *equilibrium* condition). Such is well-known in modern physics and nonequilibrium thermodynamics {41}—but *not* in electrical power engineering!

Even many simple conditions usually assumed to obey the equilibrium Second Law can be violated—e.g., in a single reservoir of uniform temperature, if the reservoir is physically inhomogeneous. For the Second Law to apply, *it is absolutely required that the reservoir of environmental energy be in equilibrium*. Quoting Yeh {26}:

From Planck's statement of the second law of thermodynamics it is generally inferred that it is impossible to construct an engine which produces work at the expense only of heat taken from the air or the ocean. ...[It is demonstrated that]... when the air and the ocean are combined as a nonhomogeneous reservoir of uniform temperature, it is possible to construct an engine which produces work by extracting heat from the said reservoir. This does not constitute a violation of the second law of thermodynamics, rather that the "reservoir" in the Planck's statement must be clearly stated as being in equilibrium.

A clear experimental proof of the excess environmental E-field interaction in the MEG is shown by measuring the angle between the current and voltage that is output from the output coil of the transformer section. Typically the output current and voltage of the COP > 1.0 MEG output are within two to five degrees of being in phase—something which does not occur in a normal transformer using only the magnetic flux inside its core. In the normal transformer, the phase angle tends toward 90°.

Areas Violating the Second Law are Known and Recognized. To show that such “sharp

gradient” systems—such as the MEG—can and do violate classical equilibrium thermodynamics, Kondepudi and Prigogine {²⁷} point out several areas already known and recognized by thermodynamicists to do so (and especially to violate the Second Law). Quoting:

"Some of these areas are (1) "... rarefied media, where the idea of local equilibrium fails. The average energy at each point depends on the temperature at the boundaries. Important astrophysical situations belong to this category." (2) "...strong gradients, where we expect the failure of linear laws such as the Fourier law for heat conduction. Not much is known either experimentally or theoretically. Attempts to introduce such nonlinear outcomes ... have led to 'extended thermodynamics'." (3) "...memory effects which appear for long times (as compared to characteristic relaxation times). ...non-equilibrium processes may have 'long time-tails'..."

The MEG appears to use two of these areas known to allow second law violation: (i) it uses strong gradients to produce its primary source of energy input, and (ii) the special nanocrystalline core material and its specially layered construction have a “memory” effect. The material and the construction freely localize the input **B**-field in the core material itself. This freely invokes the Aharonov-Bohm effect, and provides an additional **A**-potential energy reservoir in the space outside the core and surrounding it.

As stated by Kondepudi and Prigogine {41}, thermodynamicists have had to form a new branch of thermodynamics known as “extended” thermodynamics, to try to decipher the exact mechanisms involved in these known Second-Law violation areas.

In addition to the Aharonov-Bohm effect, the MEG is certainly using another of these known violation areas—sharp gradients—in order to provide a nonequilibrium system operating analogously to a heat pump. In such operation, $COP > 1.0$ is permitted by the laws of physics and the laws of nonequilibrium thermodynamics, even though the efficiency ξ of the MEG is always $\xi < 100\%$. $COP > 1.0$ is permissible because appreciable excess EM energy—in the form of strong **E**-field energy pulses—is freely input to the MEG from its **A**-potential external environment.

Even if the efficiency of the overall MEG were only $\xi = 70\%$, the excess energy input from the environment is sufficiently large that 70% of it represents much more energy than the operator

himself inputs. In that case, the MEG outputs much more energy than the operator inputs, and obeys the laws of physics and thermodynamics while doing so.

That operation of the MEG is precisely analogous to the known operation of the common heat pump. It has nothing at all to do with so-called “perpetual motion” or with “creating energy from nothing”. Indeed, the source (the Aharonov-Bohm effect) of the extra A-potential energy is well known and well-understood in physics.

The patent examiner’s own EM model—classical EM and electrical engineering—is seriously flawed. It implicitly assumes that every EM field, EM potential, and joule of EM energy in the universe is and has been created out of nothing at all, by the associated source charges. *That is in total violation of the conservation of energy law.* Using only classical EM and electrical engineering, we directly challenge the patent examiner (and anyone else) to explain the long-vexing source charge problem {82},{83}: *How does every source charge freely and continuously pour out real, observable EM energy (photons) in all directions, without any observable energy input at all?.*

If one cannot answer and resolve that problem by identifying the energy input and how it is reordered and transformed to real output EM energy (real observable photons), one has no notion at all of how any joule of EM energy arises anywhere, or how any EM field or potential arises in space or in any EM system or device.

It is believed that the patent examiner has failed to make it obvious that the source charge’s polarization of its surrounding vacuum {42}, or that—in that polarization—both the “bare source charge” and the polarization charge of opposite sign have *infinite energy* as already recognized in particle physics {42}. Any charge plus its vacuum polarization already is an *infinite energy source or infinite energy generator*, directly transducing disordered virtual state energy from the active vacuum and outputting it, indefinitely (perpetually) as real observable energy.

Every charge in the universe is already a known, proven, established free EM energy generator extracting all its input energy from the seething vacuum in virtual state form, transducing that energy into observable EM energy, and pouring out real photons and real, observable EM energy in all directions. The source charge continuously applies a negative entropy process, in complete violation of the Second Law of equilibrium thermodynamics. It continuously consumes

positive entropy of the virtual state, and converts it into ordered energy of the observable state. Further, the source charge is a *perpetual* generator, because it will freely transduce and outpour real EM energy (real photons) continuously and steadily, taking the energy directly from the active virtual state energy of the vacuum. And it will do that *perpetually* from the moment the charge appears, for as long as the charge physically exists. The charges in the original matter in the universe have been doing that for some 12.7 billion years.

This shows that, with any source charge, *unlimited energy* is already available from the interaction between that charge and its active vacuum (curved spacetime). In short, the charge is the fundamental “free energy generator” comparable to an oil well gusher. It can and does steadily pour out real EM energy (real observable photons) in all directions, unceasingly, without its “source input” (the active vacuum) ever running out—so long as the charge itself exists.

To properly understand this continuous negative entropy process of the source charge, one must pass from the old 1872 Klein geometry {²⁸} to a much more advanced and modern Leyton object-oriented geometry {²⁹}.

In Klein geometry, when symmetry is broken at a given level, the information of the order at that level is lost, and so the overall symmetry is reduced (to that of the next lower level).

In Leyton geometry, when symmetry is broken at a given level, the information is not lost, but retained. Further a new symmetry is generated at the next higher level as well—and *that is a totally negative entropy operation*. JES

Hence Leyton geometry leads to the *hierarchy of symmetries*, whereby use of broken symmetry at one level a priori generates a new symmetry at the next higher level.

Following Leyton geometry, the charge—by breaking symmetry in the vacuum’s *virtual state* particle flux—must therefore create a new symmetry at the next higher level, which is in the *observable state*. This gives a rigorous group-theoretic Leyton proof that the source charge can indeed continuously consume positive entropy in the virtual state, while producing negative entropy to form a new symmetry in the observable state—the production of the associated macroscopic fields and potentials and their energy.

The charge/vacuum polarization ensemble is a special kind of thermodynamic *steady state system far from equilibrium in its energetic virtual state energy exchange with its seething*

vacuum environment. It obeys the much more comprehensive Leyton geometry {45} rather than the older, much more restricted Klein geometry {44}, which at best was only an approximation anyway.

The continually-emitted observable photons from the source charge continually establish and replenish the associated macroscopic fields and potentials, spreading radially outward at light speed from the time of formation of the dipolar ensemble.

Further, the source charge with its input and output forms a *deterministic* steady state system, since the resulting macroscopic output field intensities and potential intensities are deterministic as a function of radial distance and time from formation of the source dipolarity. Evans and Rondoni {46} indicate that continuous production of negative entropy "remains a problem" with such a system.

The charge (and its ensemble dipolarity, when the polarization of the vacuum is included) is precisely the kind of system which has been demonstrated to be theoretically possible of furnishing continuous negative entropy by Evans and Rondoni {30}. They failed to recognize that the simple source charge and its polarization of the vacuum form an ensemble Leyton negative entropy system directly exhibiting their theoretically predicted continuous negative entropy production.

That all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed on this day of May 17, 2004

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NOTES AND REFERENCES:

1. Regauging—utilized by every electrodynamicist and gauge field theorist—*a priori* assumes that the potential and thus the potential energy of any system can be freely changed at will. To see how this is already assumed in classical electrodynamics, see J. D. Jackson, Classical Electrodynamics, Wiley, 1975, p. p. 219-221; 811-812.

Curiously, electrodynamicists always change the potentials (and the potential energy of the system) *twice*, and *arbitrarily* just so that the two extra EM fields that are produced are equal and opposite. Thus any and all excess potential energy transferred to the system from its active vacuum environment, via the regauging, is “locked up” as stress energy in the system. In that case, the free change in system potential energy cannot be used to force electron currents through loads and power them “freely”.

On the other hand, there is no law of nature requiring that *both* potentials be changed, or that they be changed only in such a way that the resulting two new force fields are equal and opposite. If only a single potential is changed, or both changed so that the two force fields are not equal and opposite, then that is *asymmetrical* regauging. In that case, a net extra force field is also created in the system. That free force field can be an extra forward emf in the system, pushing electrons through the load to dissipate that excess regauging energy as some free work in the load.

1. With the dipolarity of the “external” power source connected into the same closed loop as the system loads and losses, the standard *closed current loop circuit* is universally employed in power systems. The circuit guarantees that the back emf (destroying the dipolarity of the “external” power source) is equal to the forward emf powering the external circuit’s loads and losses.

Thus our electrical power circuits self-enforce Lorentz’s symmetrical regauging in the physical EM power system. Therefore the system power system can make no practical use of any excess regauging energy it freely receives from the active vacuum.

From an energy view, this circuit is insane! In this circuit, half the free regauging energy collected in the external circuit is used only to destroy the potential source itself (the dipolarity of the external power source) that is furnishing the Poynting energy flow to the circuit (via the broken symmetry of that dipolarity)!

In a lossless perfect system, the dipolarity of the “external” source could be restored by injecting as much external work on the shaft of the generator as the electrical energy used to destroy its dipolarity. This restores the circuit’s emf. Hence a lossless perfect system would be limited to $COP = 1.0$, and the output useful work would equal the shaft work input to the generator.

Any real system has losses and inefficiencies, and so *less* than half the collected energy in the external circuit is actually used to power the loads. In addition, the generator has inefficiencies and losses, so additional energy for its losses must be input to its shaft, in addition for the actual energy restoring the dipolarity and the flow of *free* Poynting energy *extracted from the vacuum*.

Consequently, any power generator system having losses and utilizing the closed current loop circuit is physically and deliberately limited to $COP < 1.0$. Again, there is no law of nature requiring exclusive use of the closed current loop circuit, nor is there any law of nature requiring that after the system is potentialized, the external



source must remain connected so that half the excess potential energy of the system will be dissipated inside the “external” power source to kill its dipolarity and the *free* flow of Poynting energy extracted from the vacuum.

As a result of these absolutely illogical but standard practices, every electrical power system built by our electrical engineers kills its external potentialization source faster than it powers its loads. Eerily, we pay the power company to continuously engage in a giant wrestling match inside its own generators and *always lose*.

All our power engineers have lost sight of the fact that field energy and potential energy are *sets of energy flows* (Whittaker 1903 and 1904) *freely flowing from a source dipolarity* and extracted from the local vacuum—not from the energy used to crank the shaft of the generator.

Any “static” dipolar source of potential ϕ can therefore *freely* furnish any amount of energy W that is desired, without current and thus without power and work being performed to collect the energy, if there are sufficient “pinned” or “static” collecting charges. The simple equation is $W = \phi q$. For a fixed ϕ , the amount of collected energy W depends only on the amount of q that is available for the potential ϕ to flow over and potentialize. After all, ϕ is defined as the joules W of EM energy that will collect upon *every unit point static charge that is exposed to ϕ* .

From any finite potential ϕ , any desired amount of potential energy thus can be collected on static charges q , given sufficient charges q . There need be no current or work involved at all, if charges q are “pinned” and cannot move as current. So the *energy collection* in a circuit has nothing to do with electron current and power and work. Instead, it is simply *asymmetrical regauging*—mere transfer of potential—and regauging is work-free under the well-known gauge freedom axiom of gauge field theory and quantum field theory. Regauging (change of potential) is actually a free change in the background vacuum (its virtual particle energy flux) and in the local spacetime curvature.

1. James Clerk Maxwell, "A Dynamical Theory of the Electromagnetic Field," Royal Society Transactions, Vol. CLV, 1865, p 459. Read Dec. 8, 1864. Also in The Scientific Papers of James Clerk Maxwell, 2 vols. bound as one, edited by W. D. Niven, Dover, New York, 1952, Vol. 1, p. 526-597. Two errata are given on the unnumbered page prior to page 1 of Vol. 1.

In this paper Maxwell presents his seminal theory of electromagnetism, containing 20 equations in 20 unknowns. His general equations of the electromagnetic field are given in Part III, General Equations of the Electromagnetic Field, p. 554-564. On p. 561, he specifically lists his 20 variables. On p. 562, he summarizes the different subjects of the 20 equations, being three equations each for magnetic force, electric currents, electromotive force, electric elasticity, electric resistance, total currents; and one equation each for free electricity and continuity. In the paper, Maxwell adopts the approach of first arriving at the laws of induction and then deducing the mechanical attractions and repulsions.

1. The standard “definition” of the \mathbf{E} -field, e.g., does not at all define the \mathbf{E} -field itself in massless space. Instead, it defines only *the intensity of the interaction of that massless, force-free \mathbf{E} -field in space* (whatever that \mathbf{E} -field really is) when it is interacting with a unit point static charge (having mass). The \mathbf{E} -field is thus

accurately known as the E-field intensity. E actually represents *how much energy flow is steadily diverged from that interacting actual E-field, by the unit point static charge*. Using that “definition” as if it were a definition of “the E-field as it exists in space” is a horrible logical error often made in classical Maxwell-Heaviside electrodynamics and in electrical engineering. It is the error of assuming force fields in space, when force fields exist only in and on and of matter. Such assumption perpetuates the implicit assumption of the old material ether filling all space.

1. Richard P. Feynman, Robert B. Leighton, and Matthew Sands, The Feynman Lectures on Physics, Addison-Wesley, Reading, MA, Vol. 1, 1964, p. 12-2.

1. *Ibid.*, p. 2-4.

1. This in fact allows a long-sought definition of energy. Energy is just an alteration in spacetime (general relativistic view), and an alteration of spacetime is identically energy. From a particle physics view, energy is just an alteration in the virtual particle flux of the active vacuum.

1. See T. E. Bearden, Energy from the Vacuum: Concepts and Principles, Cheniere Press, Santa Barbara, 2002, Chapter 9: The Supersystem and Remarks on Gravity, Antigravity, and Testing.

1. E.g., see (a) F. Winterberg, “Nonlinear Relativity and the Quantum Ether,” Internat. J. Fusion Energy, 3(2), Apr. 1985, p. 7-21. Quoting from p. 7-8: [Dealing with the problem of cutoff]: “...it has been frequently stated that general relativity will ultimately provide a natural cutoff at the Planck length of $\sim 10^{-32}$ cm. However, even though the mass density of the quantum-mechanical zero-point fluctuations becomes finite there, the value of the mass density turns out to be enormous, more precisely $\sim 10^{95}$ g/cm³, large enough to put the entire mass of the known universe in a cube with a side length less than 1 fermi.”

For a more conservative estimate, cf. (b) Barry Satterfield, “Exploring the Vacuum,” Journal of Theoretics, (Archives). Quoting: “In our galaxy there are in excess of 100 billion stars. If we assume they all radiate at about the same intensity as our sun, then the amount of energy expended by our entire galaxy of stars shining for one million years is roughly equivalent to the energy locked up in one cubic centimetre of space.”

As can be seen, various estimates of the vacuum energy density present different numbers, often depending on some of the setup assumptions made. For practical power system purposes, we may simply consider the vacuum energy density to be infinite or unlimited. There are a very large number of source charges in the universe, and each one of them continuously pours out photons, producing and replenishing its associated EM fields and potentials spreading at light speed from the time of formation of the charge.

So the total ensemble of all those charges continuously pours out mind-boggling EM energy, emitting immense real EM energy into space. The charges in fact extract the energy for their observable EM fields and potentials directly from the vacuum, via each charge’s polarization of the vacuum and the resulting *broken symmetry of opposite charges* thereby imposed in the vacuum’s virtual photon flux.

1. See any good physics paper or book on the characteristics of the active vacuum. E.g., from among many thousands, a few typical treatises are, (a), I. J. R. Aitchison, "Nothing's plenty: The vacuum in modern quantum field theory," Contemporary Physics, 26(4), 1985, p. 333-391; (b) Sunny Y. Auyang, How is Quantum Field Theory Possible?, Oxford University Press, New York and Oxford, 1995. Quoting Auyang, p. 151: "*Contemporary physics has a vacuum, whose meaning is the state of lowest energy. The vacuum is bubbling with quantum energy fluctuation and does not answer to the notion of empty space or dematerialized ether.*" On p. 235, note 42, Auyang points out that the energy remaining in the vacuum in this "lowest energy" state is actually infinite because there are an infinite number of nonzero nodes. (c) M. W. Evans *et al.*, "The Aharonov-Bohm Effect as the Basis of Electromagnetic Energy Inherent in the Vacuum," Foundations of Physics Letters, 15(6), Dec. 2002, p. 561-568; (d) Richard P. Feynman and A. R. Hibbs, Quantum Mechanics and Path Integrals, McGraw-Hill, New York, 1965, p. 245. One of many modern quantum mechanical and quantum electrodynamical calculations that show enormous, fiercely active EM energy density in the vacuum itself. (e) Timothy H. Boyer, "The Classical Vacuum," Scientific American, Aug. 1985, p. 70-78. (f) Timothy H. Boyer, "Random Electrodynamics: The theory of classical electrodynamics with classical electromagnetic zero-point radiation," Physical Review D, 11(4), 15 Feb. 1975, p. 790-808; (f) P. W. Milonni, The Quantum Vacuum: An Introduction to Quantum Electrodynamics, Academic Press, New York, 1994. (g) L. de la Pena and A. M. Cetto, The Quantum Dice: An Introduction to Stochastic Electrodynamics, Kluwer Academic Publisher, Dordrecht, 1996. (h) Jack S. Greenberg and Walter Greiner, "Search for the sparking of the vacuum," Physics Today, Aug. 1982, p. 24-32.

1. Some references by Nobelist Lee are significant. E.g., see (a) T. D. Lee, "Is the Physical Vacuum a Medium?", Transactions of the New York Academy of Sciences, Series II, Vol. 40, Sep. 15, 1980, p. 111-123; (b) T. D. Lee, Particle Physics and Introduction to Field Theory, Harwood, New York, 1981. On p. 380-381, Lee shows how there is no symmetry of matter alone, but only of matter and vacuum. (c) *Ibid.*, where Lee discusses the possibility of using vacuum engineering, in his "Chapter 25: Outlook: Possibility of Vacuum Engineering," p. 824-828.

1. W. Misner, K. S. Thorne, and J. A. Wheeler, Gravitation, W.H. Freeman and Co., San Francisco, 1973, p. 5.

1. See the attached paper on precursor engineering for a more complete discussion of the force-free field in space interacting with matter to produce any and all force fields.

1. See, e.g., the noted fluctuation theorem advanced by D. J. Evans and D. J. Searles, "Equilibrium microstates which generate second law violating steady states," Phys. Rev. E, Vol. 50, 1994, p. 1645-1648. A further generalization of the theorem when one manipulates the system's free energy is given by Gavin E. Crooks, "Entropy production fluctuation theorem and the nonequilibrium work relation for free energy differences," Phys. Rev. E, Vol. 60, 1999, p. 2721-2726.

1. G. M. Wang, E. M. Sevick, Emil Mittag, Debra J. Searles, and Denis J. Evans, "Experimental Demonstration of Violations of the Second Law of Thermodynamics

for Small Systems and Short Time Scales," Phys. Rev. Lett., 89(5), 29 July 2002, 050601.

1. Cf T. E. Bearden, Energy from the Vacuum: Concepts and Principles, Cheniere Press, 2002, Chapter 10. Cold Fusion: Low Spatial-Energy Nuclear Reactions at High Time-Energy.

If the normal law of attraction and repulsion of charged particles is momentarily reversed in such a proven fluctuation zone, then for a short time in that zone like charges attract rather than repel. This effectively converts—momentarily—the usual *Coulomb barrier* into a highly unusual *Coulomb attractor*.

Instead of the normal barrier preventing approaching like-charged ions from coupling each into the other's strong force region, the *reversed* "barrier" now strongly accelerates that usually prevented process. *The main thing preventing nuclear reactions at low temperature or room temperature is and always has been the coulomb barrier*. With that barrier reversed momentarily, then momentarily nuclear reactions at low temperature are enabled.

Thus the "brute force" method of high energy physics—where like ions are driven together by sheer velocity and momentum—becomes unnecessary. Instead, in a fluctuation many of the like-charged ions in a solution subjected to localized Coulomb barrier reversal can be drawn together so that the like-charged ions attracted sufficiently close together in the fluctuation region become bound into a quasi-nucleus by the strong force.

As the fluctuation then reverses and the fluctuation decays, it becomes more economical for the quasi-nucleus to "decay" by other methods such as flipping a quark, etc. Two protons drawn together into a quasi-nucleus in such a fluctuation, e.g., may have one quark in the quasi-nucleus flipped during the decay of the fluctuation, so that one proton becomes a neutron. This results in formation of a nucleus of deuterium—and the production of excess deuterium is a very frequent and "signature" product of the heretofore puzzling "cold fusion" process. Many other nuclear reactions also become possible by fluctuation reversal of the Coulomb barrier, yielding mechanisms for producing tritium, alpha particles, etc. without the normal brute force high energy methods.

1. Robert Bruce Lindsay and Henry Margenau, Foundations of Physics, Dover, NY, 1963, p. 217.

1. *Ibid.*, p. 213.

1. *Ibid.*, p. 215.

1. A. A. Michelson and E. W. Morley, "Influence of motion of the medium on the velocity of light," American Journal of Science, Vol. 31, Series 3, 1886, p. 377-386; — "The relative motion of the earth and the luminiferous aether," American Journal of Science, 4(3), 1887, p. 333; — "On the relative motion of the earth and the luminiferous aether," Phil. Mag. 24(4), 1887, p. 449.

1. For an informal discussion of the ramifications of this error, and a discussion of the startling energetics technology that results when the actual massless fields themselves are engineered and utilized, see T. E. Bearden, "Precursor Engineering: Directly Altering Physical Reality," in Journal of New Energy, 2004 (in press).

1. See Robert Bruce Lindsay and Henry Margenau, Foundations of Physics, Dover, New York, 1963, p. 217 for a blunt statement of that fact.
1. *Ibid.*, p. 217.
1. Ilya Prigogine, "Irreversibility as a symmetry-breaking process," Nature, Vol. 246, Nov. 9, 1973, p.70.
1. *Ibid.*, p. 71.
1. David Halliday and Robert Resnick, Fundamentals of Physics, Third Edition Extended, Wiley, New York, 1988, Vol. 1, p. 518, Sample Problem 5.
1. (a) Y. Aharonov and D. Bohm, "Significance of Electromagnetic Potentials in the Quantum Theory," Physical Review, Second Series, 115(3), 1959, p. 485-491. (b) Y. Aharonov and D. Bohm, "Further considerations on electromagnetic potentials in the quantum theory," Physical Review, 123(4), Aug. 15, 1961, p. 1511-1524.
1. (a) R. G. Chambers, "Shift of an electron interference pattern by enclosed magnetic flux," Physical Review Letters, Vol. 5, July 1960, p. 3-5. This was the first experimental proof of the Aharonov-Bohm effect. For a rigorous and very definitive experimental proof of the effect, see (b) A. Tonomura *et al.*, "Evidence for Aharonov-Bohm effect with magnetic field completely shielded from electron wave," Phys. Rev. Lett., Vol. 56, 1986, p. 792-795. Tonomura *et al.* used a high resolution electron holography interference microscope and definitively verified the Aharonov-Bohm effect. In 1999 Akira Tonomura received the Franklin Institute Award for this beautiful work.
1. Indeed, researchers have found the Aharonov-Bohm effect in a wide variety of phenomena. For typical modern references of widely appearing examples, see (a) B. E. Allman, W.-T. Lee, O. I. Motrunich, and S. A. Werner, "Scalar Aharonov-Bohm Effect with Longitudinally Polarized Neutrons", Phys. Rev. A, Vol. 60, 1999, p. 4272; (b) A. Bachtold *et al.*, "Aharonov-Bohm oscillations in carbon nanotubes," Nature, Vol. 397, 1999, p. 673-675; (c) G. Badurek, H. Weinfurter, R. Gahler, A. Kollmar, S. Wehlinger, and A. Zeilinger, "Nondispersive phase of the Aharonov-Bohm effect," Phys. Rev. Lett., 71(3), 1993, p. 307-311; (d) M. W. Evans *et al.*, "The Aharonov-Bohm Effect as the Basis of Electromagnetic Energy Inherent in the Vacuum," Foundations of Physics Letters, 15(6), Dec. 2002, p. 561-568; (e) M. V. Berry, "The Aharonov-Bohm effect is real physics not ideal physics," in Fundamental Aspects of Quantum Theory, eds. V Gorini and A Frigerio, Plenum, NATO ASI series vol. 144, 1986, p. 319-320; (f) M. V. Berry, "The adiabatic phase and Pancharatnam's phase for polarized light," Journal of Modern Optics, 34(11), 1987, p. 1401-1407; (g) Ya. M. Blanter, C. Bruder, R. Fazio, and H. Schoeller, "Aharonov-Bohm-type Oscillations of Thermopower in a Quantum-dot Ring," Phys. Rev. B, Vol. 55, 1997, p. 4069; (h) M. Chaichian, A. Demichev, P. Presnajder, M. M. Sheikh-Jabbari and A. Tureanu, "Quantum theories on noncommutative spaces with nontrivial topology: Aharonov-Bohm and Casimir effects," Nucl Phys B, Vol. 611, 2001, p. 383-402; (i) B. Helffer, "Effet d'Aharonov-Bohm sur un état borné de l'équation de Schrödinger," Commun. Math. Phys., Vol. 119, 1988, p. 315-329; (j) S. Olariu and I. Iovitzu Popescu, "The Quantum Effects of Electromagnetic Fluxes,"

Reviews of Modern Physics, 57(2), Apr. 1985, p. 339-436. The latter paper presents hundreds of references and an extensive discussion of the Aharonov-Bohm effect.

1. M. V. Berry, "Quantal phase factors accompanying adiabatic changes," Proc. Roy. Soc. Lond., Vol. A392, 1984, p. 45-57.

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1. M. W. Evans and S. Jeffers, "The Present Status of the Quantum Theory of Light," in Modern Nonlinear Optics, Second Edition, 3 Vols., edited by M.W. Evans, Wiley, 2001, Vol. 3, p. 150.

1. Myron W. Evans, "O(3) Electrodynamics," in Modern Nonlinear Optics, Second Edition, 3 Vols., edited by M.W. Evans, Wiley, New York, 2001, Part 1, p. 84.

1. M. W. Evans *et al.*, "The Aharonov-Bohm Effect as the Basis of Electromagnetic Energy Inherent in the Vacuum," Foundations of Physics Letters, 15(6), Dec. 2002, p. 561-568.

1. M. W. Evans *et al.*, "Runaway Solutions of the Lehnert Equations: The Possibility of Extracting Energy from the Vacuum," Journal of New Energy, 4(3), Special Issue, Winter 1999, p. 195-198.

1. M. W. Evans *et al.*, "Classical Electrodynamics without the Lorentz Condition: Extracting Energy from the Vacuum," Physica Scripta 61(5), May 2000, p. 513-517.

1. M. W. Evans, T. E. Bearden, and A. Labounsky, "The Most General Form of the Vector Potential in Electrodynamics," Foundations of Physics Letters, 15(3), June 2002, p. 245-261.

1. M.W. Evans, "Derivation of the Geometrical Phase from the Evans Phase Law of Generally Covariant Unified Field Theory," Foundations of Physics Letters, 17(4), Aug. 2004, p. 393-401 (in press).

1. M. W. Evans, "Some Notes on the Explanation of Physical Optics, the Sagnac Effect, and the Aharonov-Bohm Effect with Generally Covariant Unified Field Theory," Foundations of Physics Letters (in review).

1. Hsu-Chieh Yeh, "Remark on the second law of thermodynamics," American Journal of Physics, 52(8), Aug. 1984, p. 720. The schematic diagram of the machine that proves it is shown on p. 721.

1. Dilip Kondepudi and Ilya Prigogine, Modern Thermodynamics: From Heat Engines to Dissipative Structures, Wiley, Chichester, 1998, reprinted 1999 with corrections, p. 459.

1. Steven Weinberg, Dreams of a Final Theory, Vintage Books, Random House, 1993, p. 109-110.

1. What we call "potentialization" of a charge—or refer to as its "collecting of excess EM energy"—involves a change of the active local vacuum potential in which the charge is embedded. The potential flow in space changes the potential of space itself. So when a Poynting energy flow moves over a charge, the background space potential

intensity in which the charge is embedded is altered by a given amount. For increases in this background potential, the charge now interacts with a greater-than-ambient vacuum potential. Hence the charge diverges additional energy flow from that increased energetic exchange.

1. (a) Felix Klein, "Vergleichende Betrachtungen über neuere geometrische Forschungen," 1872. Klein's Erlanger program was initiated in 1872 to describe geometric structures in terms of their automorphism groups. It has driven much of the physics development in the twentieth century. See also (b) I. M. Yaglom, Felix Klein and Sophus Lie: Evolution of the Idea of Symmetry in the Nineteenth Century, Birkhäuser, Boston, MA, 1988.

1. Michael Leyton, A Generative Theory of Shape, Springer-Verlag, Berlin, 2001. A new class of groups is developed, called *unfolding groups*. These unfold structure from a maximally collapsed version of that structure. A principal aspect of the theory is that it develops a group-theoretic formalization of major object-oriented concepts such as inheritance. The result is an *object-oriented theory of geometry*, and it is much more advanced than the old Klein geometry it replaces. We also propose Leyton's unfolding process as a fundamental re-ordering process of nature.

1. D. J. Evans and Lamberto Rondoni, "Comments on the Entropy of Nonequilibrium Steady States," J. Stat. Phys., 109(3-4), Nov. 2002, p. 895-920.

1. *Ibid.*, p. 3. However, we note that every charge in the universe, together with its vacuum polarization ensemble, already has infinite energy, as pointed out by leading physicists such as Nobelist Weinberg {**Error! Bookmark not defined.**}. The charge also continuously produces negative entropy as pointed out by Bearden {**Error! Bookmark not defined.**},{**Error! Bookmark not defined.f**},{**Error! Bookmark not defined.**}, with "already negative" entropy produced from the beginning and further decreasing toward negative infinity as time passes. Thus the charge and the dipole are two physical systems which do continuously produce the peculiar negative entropy process theoretically uncovered by Evans and Rondoni.

1. (a) T. D. Lee, "Question of Parity Conservation in Weak Interactions," Physical Review, 104(1), Oct. 1, 1956, p. 254-259. Errata are given in Phys. Rev. 106(6), June 15, 1957, p. 1371. (b) T. D. Lee, Reinhard Oehme, and C. N. Yang, "Remarks on Possible Noninvariance under Time Reversal and Charge Conjugation," Physical Review, 106(2), 1957, p. 340-345

1. C. S. Wu, E. Ambler, R. W. Hayward, D. D. Hoppes and R. P. Hudson, "Experimental Test of Parity Conservation in Beta Decay," Physical Review, Vol. 105, 1957, p. 1413.

1. Felix Finster, "Definition of the Dirac Sea in the Presence of External Fields," Adv. Theor. Math. Physics, Vol. 2, 1998, p. 963-985.

1. F. Finster, J. Smoller, and S.-T. Yau, "The Interaction of Dirac Particles with Non-Abelian Gauge Fields and Gravity—Bound States," Nucl. Phys. B584, 2000, p. 387-414.

1. Kondepudi and Prigogine, *ibid.*, p. xv.

1. T. E. Bearden, "Refuting the Perpetual Motion Objection", 2004.
1. T. E. Bearden, "Errors in the Classical EM Model and Electrical Engineering," 2004.
1. T. E. Bearden, "Precursor Engineering: Directly Altering Physical Reality," in Journal of New Energy, 2004 (in press).
1. Ilya Prigogine, "Irreversibility as a symmetry-breaking process," Nature, Vol. 246, Nov. 9, 1973, p.71.
1. T. D. Lee, Particle Physics and Introduction to Field Theory, Harwood, New York, 1981, p. 184.
1. Jackson, Classical Electrodynamics, Third Edition, Wiley, 1998, p. 558.
1. T. D. Lee, *ibid.*
1. Every charge in the universe exhibits these five functions. See (a) T. E. Bearden, Energy from the Vacuum: Concepts and Principles, Cheniere Press, Santa Barbara, CA, 2002, Chapter 3. Giant Negentropy, Dark Energy, Spiral Galaxies and Acceleration of the Expanding Universe. See also (b) M. W. Evans, T. E. Bearden, and A. Labounsky, "The Most General Form of the Vector Potential in Electrodynamics," Foundations of Physics Letters, 15(3), June 2002, p. 245-261.
1. Kondepudi and Prigogine, *ibid.*, p. 336, footnote.
1. Kondepudi and Prigogine, Modern Thermodynamics: From Heat Engines to Dissipative Structures, Wiley, Chichester, 1998, p. xii.]
1. D. Hilbert, Gottingen Nachrichten, Vol. 4, 1917, p. 21.
1. Logunov and Loskutov, "Nonuniqueness of the predictions of the general theory of relativity," Sov. J. Part. Nucl., 18(3), May-June 1987, p. 179.
1. Dilip Kondepudi and Ilya Prigogine, *ibid*, p. 459.
1. *Ibid.* p. 61.
1. *Ibid.*, p. xii.
1. Y. Aharonov and D. Bohm, "Significance of Electromagnetic Potentials in the Quantum Theory," Physical Review, Second Series, 115(3), 1959, p. 485-491. Established what is called the "Aharonov-Bohm effect," accomplished by a toroidal coil and a very long solenoid. In the AB effect, the magnetic field **B** is localized to a finite region, in which case a field-free (curl-free) magnetic vector potential **A** appears in the space outside the **B**-localization zone. Note that the later Berry Phase is a generalization of the Aharonov-Bohm effect. Aharonov and Berry shared the Wolf Prize in 1998 for "*the discovery of quantum topological and geometrical phases, specifically the Aharonov-Bohm effect, the Berry phase, and their incorporation into many fields of physics*".
1. Banesh Hoffman, Foreword, to Yakov P. Terletski, Paradoxes in the Theory of Relativity, translated from the Russian, Plenum Press, New York, 1968, p. viii.
1. John C. Bedini, private communication.

1. J. D. Jackson, Classical Electrodynamics, Second Edition, Wiley, 1975, p. 811-812 gives a discussion of this subject and a specific example.
1. Ilya Prigogine, From Being to Becoming: Time and Complexity in the Physical Sciences, W.H. Freeman and Company, San Francisco, 1980, p. 104.
1. T. D. Lee, "Space Inversion, Time Reversal and Particle-Antiparticle Conjugation," Physics Today, 19(3), Mar. 1966, p. 23.
1. Raymond A. Serway, Physics for Scientists and Engineers with Modern Physics, Third edition, updated version, Saunders College Publishing, Philadelphia *et al.*, 1990, p. 620.
1. Huw Price, Time's Arrow and Archimedes' Point, Oxford University Press, 1996, paperback 1997, p. 36.
1. *Ibid.*, p. 78.
1. E. T. Whittaker, "On the Partial Differential Equations of Mathematical Physics," Mathematische Annalen, Vol. 57, 1903, p. 333-355.
1. E. T. Whittaker, "On an Expression of the Electromagnetic Field Due to Electrons by Means of Two Scalar Potential Functions," Proc. Lond. Math. Soc., Series 2, Vol. 1, 1904, p. 367-372. The paper was published in 1904 and orally delivered in 1903. From the two Whittaker papers cited, any static EM field or EM potential decomposes into steady state EM energy flows. These flows are initiated (by the charge extracting the energy from the seething vacuum) from the moment of formation of the field or potential, and they freely continue so long as the field or potential exists.
1. For a summary of superpotential theory, see Melba Phillips, "Classical Electrodynamics," in Principles of Electrodynamics and Relativity, Vol. IV of Encyclopedia of Physics, edited by S. Flugge, Springer-Verlag, 1962.
1. Tom Van Flandern, "The speed of gravity – What the experiments say," Physics Letters A, Vol. 250, Dec. 21, 1998, p. 8-9. Quoting: "*To retain causality, we must distinguish two distinct meanings of the term 'static'. One meaning is unchanging in the sense of no moving parts. The other meaning is sameness from moment to moment by continual replacement of all moving parts. We can visualize this difference by thinking of a waterfall. A frozen waterfall is static in the first sense, and a flowing waterfall is static in the second sense. Both are essentially the same at every moment, yet the latter has moving parts capable of transferring momentum, and is made of entities that propagate.*" We comment that, since photons possess angular momentum and are moving at light speed, the "static" EM field is static in the sense of Van Flandern's unfrozen waterfall. As shown by Whittaker in 1904, the static EM field is actually a steady state set of EM energy flows.
1. E.g., see M. W. Evans and S. Jeffers, "The Present Status of the Quantum Theory of Light," in Modern Nonlinear Optics, Second Edition, 3 Vols., edited by M.W. Evans, Wiley, 2001, Vol. 3, p. 150. Quoting: "*...the Aharonov-Bohm effect is a local gauge transformation of the true vacuum...[which] produces a vector potential from the true vacuum. [This gauge transformation] produces topological charge..., the*

electromagnetic field, which carries energy, and the vacuum charge current density first proposed by Lehnert ... and developed by Lehnert and Roy...".

1. D. K. Sen, Fields and/or Particles, Academic Press, London and New York, 1968, p. viii.

1. B. P. Kosyakov, "Radiation in electrodynamics and in Yang-Mills theory," Sov. Phys. Usp. 35(2), Feb. 1992, p. 135, 141.

1. T. E. Bearden, "Giant Negentropy from the Common Dipole," Proceedings of Congress 2000, St. Petersburg, Russia, Vol. 1, July 2000, p. 86-98. Also published in Journal of New Energy, 5(1), Summer 2000, p. 11-23.

1. (a), (M. W. Evans, T. E. Bearden, and A. Labounsky, "The Most General Form of the Vector Potential in Electrodynamics," Foundations of Physics Letters, 15(3), June 2002, p. 245-261; (b) M. W. Evans, P. K. Anastasovski, T. E. Bearden *et al.*, "Explanation of the Motionless Electromagnetic Generator with O(3) Electrodynamics," Foundations of Physics Letters, 14(1), Feb. 2001, p. 87-94; (c) M. W. Evans, P. K. Anastasovski, T. E. Bearden *et al.*, "Explanation of the Motionless Electromagnetic Generator by Sachs's Theory of Electrodynamics," Foundations of Physics Letters, 14(4), 2001, p. 387-393; (d) M. W. Evans *et al.*, "The Aharonov-Bohm Effect as the Basis of Electromagnetic Energy Inherent in the Vacuum," Foundations of Physics Letters, 15(6), Dec. 2002, p. 561-568; (e) M. W. Evans, P. K. Anastasovski, T. E. Bearden *et al.*, "Classical Electrodynamics Without the Lorentz Condition: Extracting Energy from the Vacuum," Physica Scripta 61(5), May 2000, p. 513-517; (f) T. E. Bearden, "Extracting and Using Electromagnetic Energy from the Active Vacuum," in M. W. Evans (ed.), Modern Nonlinear Optics, Second Edition, 3 vols., Wiley, 2001; Vol. 2, p. 639-698; (g) T. E. Bearden, "Energy from the Active Vacuum: The Motionless Electromagnetic Generator," in M. W. Evans (Ed.), Modern Nonlinear Optics, Second Edition, 3-vols., Wiley, 2001; Vol. 2, p. 699-776.

1. T. E. Bearden, Energy from the Vacuum: Concepts and Principles, Cheniere Press, Santa Barbara, CA, 2002.

1. J. D. Jackson, Classical Electrodynamics, Second Edition, Wiley, New York, 1975, p. 219-211; 811-812.

1. E.g., see H. A. Lorentz, (1892), "La Théorie électromagnétique de Maxwell et son application aux corps mouvants," [The Electromagnetic Theory of Maxwell and its application to moving bodies], Arch. Néerl. Sci., Vol. 25, 1892, p. 363-552. [Also in Lorentz, H. A., Collected Papers, The Hague: Martinus Nijhoff, vol. 2, pp. 168-238, esp. p. 168.] This is the work that Lorentz cites later (in 1895) for his proof of the symmetrical regauging theorems (the two equations of symmetrical regauging).

1. But see J. D. Jackson and L. B. Okun, "Historical roots of gauge invariance," Rev. Mod. Phys., 73, July 2001, p. 673. Actually H. A. Lorentz received credit for the symmetrical regauging of the Maxwell-Heaviside equations, when in fact the regauging was done much earlier by Lorenz. See Ludvig Valentin Lorenz, "Om lyset," Tidskr. Fys. Chem., Vol. 6, 1867, p. 1-9; published in English the same year in Philosophical Magazine, Vol. 34, 1867, p. 287-301. In this paper Lorenz gave essentially what today is called the Lorentz symmetrical regauging, several years

before H. A. Lorentz wrote his own doctoral thesis. Jackson and Okun set the record straight on who did what first.

1. Cf M. W. Evans and S. Jeffers, "The Present Status of the Quantum Theory of Light," in Modern Nonlinear Optics, Second Edition, 3 Vols., edited by M.W. Evans, Wiley, 2001, Vol. 3, p. 150. See reference {**Error! Bookmark not defined.**} for an excellent quote.

1. M. W. Evans *et al.*, "Explanation of the Motionless Electromagnetic Generator with $O(3)$ Electrodynamics," Foundations of Physics Letters, 14(1), Feb. 2001, p. 87-94. The authors point out that the theoretical explanation of the MEG with $O(3)$ electrodynamics is straightforward: Magnetic energy is taken directly ex vacua and used to replenish the permanent magnets of the MEG device, which therefore produces a source of energy that, in theory, can be replenished indefinitely from the vacuum. Such a result is incomprehensible in $U(1)$ Maxwell-Heaviside electrodynamics (which includes standard electrical engineering).

1. M. W. Evans *et al.*, "Explanation of the Motionless Electromagnetic Generator by Sachs's Theory of Electrodynamics," Foundations of Physics Letters, 14(4), 2001, p. 387-393. The motionless electromagnetic generator (MEG) takes electromagnetic energy from Riemannian curved space-time and in consequence outputs ... more energy than inputted by the operator himself. Therefore, it is shown in the most general manner that electromagnetic energy can be extracted from vacuum and used to power working devices such as the MEG.

1. (a) T. D. Lee, "Question of Parity Conservation in Weak Interactions," Physical Review, 104(1), Oct. 1, 1956, p. 254-259; (b) T. D. Lee, Reinhard Oehme, and C. N. Yang, "Remarks on Possible Noninvariance under Time Reversal and Charge Conjugation," Physical Review, 106(2), 1957, p. 340-345. Also in T. D. Lee, Selected Papers, Gerald Feinberg, Ed., Birkhauser, Boston, 1986, Vol. 2, p. 251-256.

1. C. S. Wu, E. Ambler, R. W. Hayward, D. D. Hoppes and R. P. Hudson, "Experimental Test of Parity Conservation in Beta Decay," Physical Review, Vol. 105, 1957, p. 1413.

1. Tom Van Flandern, *ibid.*, p. 9-9. See reference {**Error! Bookmark not defined.**} for the quote.

1. E.g., see (a) T. D. Lee, "Is the Physical Vacuum a Medium?" Transactions of the New York Academy of Sciences, Series II, Vol. 40, Sep. 15, 1980, p. 111-123; (b) T. D. Lee, Particle Physics and Introduction to Field Theory, Harwood, New York, 1981. Particularly see Chapter 25, where Nobelist Lee in fact raises the probability of eventually extracting useful energy from the vacuum.

1. E.g., see particularly (a) M. W. Evans *et al.*, "The Aharonov-Bohm Effect as the Basis of Electromagnetic Energy Inherent in the Vacuum," Foundations of Physics Letters, 15(6), Dec. 2002, p. 561-568; (b) M. W. Evans, "Physical Optics, the Sagnac Effect, and the Aharonov-Bohm Effect in the Evans Unified Field Theory," Foundations of Physics Letters, 17(4), Aug. 2004, p. 301-322 (in press); (c) M. W. Evans, "Derivation of the Geometrical Phase from the Evans Phase Law of Generally Covariant Unified Field Theory," Foundations of Physics Letters, 17(4), Aug. 2004,

p. 393-401 (in press); (d) M. W. Evans, T. E. Bearden, and A. Labounsky, "The Most General Form of the Vector Potential in Electrodynamics," Foundations of Physics Letters, 15(3), June 2002, p. 245-261; (e) M. W. Evans *et al.*, "Classical Electrodynamics Without the Lorentz Condition: Extracting Energy from the Vacuum," Physica Scripta 61(5), May 2000, p. 513-517; (f) M. W. Evans, "O(3) Electrodynamics," Modern Nonlinear Optics, 2nd Edition, Part 2; Vol. 2, p. 79-267; (g) M. W. Evans and S. Jeffers, "The Present Status of the Quantum Theory of Light," Modern Nonlinear Optics, 2nd Edition, Part 3; Vol. 3, p. 1-196.

1. Jed Z. Buchwald, From Maxwell to Microphysics, University of Chicago Press, Chicago and London, 1985, p. 44.

1. For a very succinct and clear statement, see Steven Weinberg, Dreams of a Final Theory, Vintage Books, Random House, 1993, p. 109-110. Nobelist Weinberg clearly states the modern knowledge that any observable charge actually involves two different infinite charges of opposite signs, and their finite difference.

1. This is in fact what the great Gabriel Kron called his "open path". E.g., see Gabriel Kron, "The Frustrating Search for a Geometrical Model of Electrodynamical Networks," Tensor (new series), Vol. 13, 1963, p. 111-128. Quoting from p. 114: *"...the missing concept of 'open-paths' (the dual of 'closed-paths') was discovered, in which currents could be made to flow in branches that lie between any set of two nodes. (Previously—following Maxwell—engineers tied all of their open-paths to a single datum-point, the 'ground'). That discovery of open-paths established a second rectangular transformation matrix... which created 'lamellar' currents..." "A network with the simultaneous presence of both closed and open paths was the answer to the author's years-long search."*

1. Tony R. Kuphaldt, Lessons in Electric Circuits, Vol. 1, D.C., <http://www.ibiblio.org/obp/electricCircuits/DC/index.html>, Jan. 5, 2003; Chapter 12: Physics of Conductors and Insulators, under "Superconductivity".

1. Bimalendu N. Roy, Fundamentals of Classical and Statistical Thermodynamics, Wiley, Chichester, 2002, p. 59.

1. Of quite a few commercial sources, a typical one is Colorado Superconductor, Inc. Another source is Images Co., which may be accessed at www.imagesco.com.

1. Colorado Superconductor includes the scientific calculation of the half life of the superconducting current as 10^{23} years. It may be accessed on the internet at http://www.users.qwest.net/~csconductor/Experiment_Guide/Energy%20Storage%20Ring.htm.

1. Colorado Superconductor took its explanations directly from the experimental procedures described by Dr. Donald L. Shirer of the Yale University Physics Department and by Dr. Peter Heller and his colleagues at Brandeis University.

1. An excellent student treatment is given by Fuhan Liu, Rochelle R. Tucker, and Peter Heller, "Nitrogen Temperature Storage Ring Experiment," American Journal of Physics, 58(3), Mar. 1990, p. 211-218. The Dutch physicist, Heike Kammerlingh Onnes, discovered superconductivity in a series of experiments beginning in 1911. In one of his early experiments with a superconducting current flowing in a lead wire

loop at 4° Kelvin, the current continued for more than a year without any serious current loss. Onnes was awarded the Nobel Prize in 1913.

1. Max Planck, Treatise on Thermodynamics, 3rd ed., Dover, New York, 1945.

1. Simply consider the alternative situation, if the object did not remain perpetually in its state of motion in the absence of any further forceful intervention. Then an object placed in motion could and would simply change its state of motion willy-nilly without intervention. There would be no such thing as “stability of motion” at any scale in the universe. In that case, the *observable ordered universe we observe and inhabit could not and would not even exist*, because all motion would be erratically and unpredictably changing chaotically without any forceful causes whatsoever.

After all, cause-and-effect is a fundamental ordering concept. Without cause and effect, there is only disorder. Hence perpetual motion (Newton’s first law) is necessary in order for cause-and-effect to exist. Without the law of perpetual motion, the ordered universe we observe would not even exist, nor would we ourselves. So as an example, one simply touches one hand against the other to prove that perpetual motion is real and is a law of nature.

1. Gabriel Kron, “Electric circuit models of the Schrödinger equation,” Phys. Rev. 67(1-2), Jan. 1 and 15, 1945, p. 41.

1. The well-known *gauge freedom principle* assures that regauging energy is work-free energy. Every electrodynamicist already accepts gauge freedom. Unfortunately, in classical Maxwell-Heaviside electrodynamics and electrical engineering, gauge freedom has been primarily utilized to *prevent* $COP > 1.0$ system performance, by arbitrarily assuming only symmetrical regauging. E.g., see J. D. Jackson, Classical Electrodynamics, Second Edition, 1975, p. 219-211; 811-812. To insure that the actual circuits self-enforce symmetrical regauging and $COP < 1.0$, the ubiquitous closed current loop circuit—containing the “external” power source’s dipolarity as a special back emf load—is utilized by electrical power engineers.

1. By “normal” transformer we mean a transformer that complies with, and can be analyzed by, the conventional Lorentz-regauged Maxwell-Heaviside model and therefore by the standard electrical power engineering model. The MEG does not comply with said conventional Lorentz-regauged Maxwell-Heaviside model, does not comply with the standard electrical power engineering model, and thus must be analyzed by a broader physics including the evocation and utilization of (i) an active vacuum, (ii) a curved spacetime, (iii) gauge transformation of the surrounding active vacuum/spacetime environment in space outside the MEG core, and (iv) the deliberate evocation and utilization of the Aharonov-Bohm effect and the reaction $dA/dt = -E$ in order to freely provide excess EM energy inputs to every coil wound on the MEG core.